What is Claimed is:

1. A powder batch comprising composite electrocatalyst particles, said electrocatalyst particles comprising a support phase and an active species phase dispersed on said support phase, wherein said support phase comprises primary support particles having an average size of from about 10 to about 100 nanometers, wherein the average cluster size of said active species phase is not greater than about 20 nanometers and wherein said electrocatalyst particles have a surface area of at least about 90 m^2/g.

2. A powder batch as recited in Claim 1, wherein said active species phase has an average cluster size of from about 0.5 nanometers to about 5 nanometers.

3. A powder batch as recited in Claim 1, wherein at least about 50 percent of said active species phase has a cluster size of not greater than about 3 nanometers.

4. A powder batch as recited in Claim 1, wherein said active species phase comprises a metal.

5. A powder batch as recited in Claim 1, wherein said active species phase comprises a platinum group metal.

6. A powder batch as recited in Claim 1, wherein said active species phase comprises a metal oxide.

7. A powder batch as recited in Claim 1, wherein said active species phase comprises a transition metal oxide.

8. A powder batch as recited in Claim 1, wherein said active species phase comprises manganese oxide.

9. A powder batch as recited in Claim 1, wherein said electrocatalyst particles have a surface area of at least about 200 m^2/g.

10. A powder batch as recited in Claim 1, wherein said primary support particles comprise carbon.

11. A powder batch as recited in Claim 1, wherein said primary support particles comprise graphitic carbon.

12. A powder batch as recited in Claim 1, wherein said electrocatalyst particles have an average particle size of not greater than about 10 μm.

13. A powder batch as recited in Claim 1, wherein said electrocatalyst particles have an average particle size of from about 1 μm to about 10 μm.

14. A powder batch as recited in Claim 1, wherein said electrocatalyst particles are substantially spherical.

15. A powder batch as recited in Claim 1, wherein said electrocatalyst particles comprise from about 20 to about 40 weight percent of said active species phase.

16. A powder batch as recited in Claim 1, wherein said electrocatalyst particles have a porosity of at least about 40 percent.

17. A powder batch of metal-carbon composite electrocatalyst particles, said electrocatalyst particles comprising a carbon support phase and a metal active species phase dispersed on said support phase, wherein said support phase comprises primary carbon particles having an average size of from about 20 to about 40 nanometers and wherein the average cluster size of said metallic active species phase is not greater than about 10 nanometers.

18. A powder batch as recited in Claim 17, wherein said metallic active species phase comprises a platinum group metal.

19. A powder batch as recited in Claim 17, wherein said metallic active species phase comprises platinum metal.

20. A powder batch as recited in Claim 17, wherein said active species phase comprises a metal alloy.

21. A powder batch as recited in Claim 17, wherein said electrocatalyst powders have a surface area of at least about 200 m^2/g.

22. A powder batch as recited in Claim 17, wherein said electrocatalyst powders have a porosity of at least about 40 percent.

23. A powder batch as recited in Claim 17, wherein at least about 50 weight percent of said active species phase has a cluster size of not greater than about 3 nanometers.

24. A powder batch of composite electrocatalyst particles, said electrocatalyst particles comprising a carbon support phase and a metal oxide active species phase dispersed on said support phase, wherein said support phase comprises primary support particles having an average size of from about 20 to about 40 nanometers and wherein the average cluster size of said metal oxide active species phase is not greater than about 10 nanometers.

25. A powder batch as recited in Claim 24, wherein said metal oxide active species phase comprises a transition metal oxide.

26. A powder batch as recited in Claim 24, wherein said metal oxide active species phase comprises manganese oxide.

27. A powder batch as recited in Claim 24, wherein said electrocatalyst particles have a surface area of at least about 200 m^2/g.

28. A powder batch as recited in Claim 24, wherein said electrocatalyst particles have a porosity of at least about 40 percent.

29. A method for the production of composite electrocatalyst particles, comprising the steps of:

a) generating an aerosol of droplets from a precursor liquid wherein said precursor liquid comprises at least a first precursor to a support phase and at least a second precursor to an active species phase;

b) moving said droplets in a carrier gas; and

c) heating said droplets to remove liquid therefrom and react at least one of said first and second precursors to form composite electrocatalyst particles wherein said active species phase is dispersed on said support phase.

30. A method as recited in Claim 29, wherein said carrier gas is air.

31. A method as recited in Claim 29, wherein said carrier gas is nitrogen.

32. A method as recited in Claim 29, wherein said heating step comprises passing said droplets through a heating zone having a reaction temperature of not greater than about 400°C.

33. A method as recited in Claim 29, wherein said heating step comprises passing said droplets through a heating zone having a reaction temperature of not greater than about 300°C.

34. A method as recited in Claim 29, wherein said active species phase is a metal and wherein said precursor liquid further comprises a reducing agent.

35. A method as recited in Claim 29, wherein said active species phase is a metal oxide and wherein said precursor liquid further comprises an oxidizing agent.

36. A method as recited in Claim 29, wherein said first precursor comprises particulate carbon.

37. A method as recited in Claim 29, wherein said first precursor comprises particulate carbon having a surface area of at least about 200 m^2/g.

38. A method as recited in Claim 29, wherein said first precursor comprises particulate carbon having an average size of from about 20 to about 40 nanometers.

39. A method as recited in Claim 29, wherein said step of generating an aerosol comprises ultrasonically atomizing said liquid.

40. A method as recited in Claim 29, wherein said step of generating an aerosol comprises passing said precursor liquid through a two-fluid nozzle.

41. A method for the production of composite electrocatalyst particles, comprising the steps of:

a) forming a liquid precursor comprising a particulate carbon precursor and at least a first precursor to an active species phase;

b) generating an aerosol of droplets from said liquid precursor; and

c) heating said aerosol of droplets in a spray dryer at a conversion temperature of not greater than about 400°C to form electrocatalyst particles wherein said first precursor is converted to an active species phase dispersed on said support phase.

42. A method as recited in Claim 41, wherein said liquid precursor comprises a reducing agent.

43. A method as recited in Claim 41, wherein said liquid precursor comprises an oxidizing agent.

44. A method as recited in Claim 41, wherein said conversion temperature is not greater than about 300°C.

45. A method as recited in Claim 41, wherein said particulate carbon precursor has a surface area of at least about 600 m^2/g.

46. A method as recited in Claim 41, wherein said step of generating an aerosol comprises passing said liquid precursor through a two-fluid nozzle.

47. A method for making particles including a polymer phase, comprising the steps of:

a) forming a liquid-containing precursor comprising at least a first precursor component and a polymer emulsion;

b) generating an aerosol of precursor droplets from said liquid-containing precursor; and

c) heating said aerosol of precursor droplets to remove liquid therefrom and form said particles.

48. A method for making particles as recited in Claim 47, wherein said first precursor component comprises a particulate precursor.

49. A method for making particles as recited in Claim 47, wherein said first precursor component comprises particulate carbon.

50. A method for making particles as recited in Claim 47, wherein said first precursor component comprises particulate carbon having an average particle size of not greater than about 100 nanometers.

51. A method for making particles as recited in Claim 47, wherein said first precursor component comprises particulate carbon having a surface area of at least about 25 m^2/g.

52. A method for making particles as recited in Claim 47, wherein said first precursor component comprises particulate carbon having a surface area of at least about 90 m^2/g.

53. A method for making particles as recited in Claim 47, wherein said polymer is a fluorocarbon polymer.

54. A method for making particles as recited in Claim 47, wherein said polymer is a tetrafluoroethylene fluorocarbon polymer.

55. A method for making particles as recited in Claim 47, wherein said heating step comprises heating said aerosol to a temperature of not greater than about 400°C.

56. A method for making particles as recited in Claim 47, wherein said heating

step comprises heating said aerosol to a temperature of not greater than about 300°C.

57. A method for making particles as recited in Claim 47, wherein said liquid precursor comprises a second precursor component.

58. A method for making particles as recited in Claim 47, wherein said liquid precursor comprises a carbon precursor and a platinum precursor.

59. A method for making particles as recited in Claim 47, wherein said first precursor component comprises graphitic carbon and further comprising a second precursor component comprising amorphous carbon.

60. A electrode assembly, comprising:

a) a current collector disposed on a gas diffusion layer; and

b) an electrocatalyst layer disposed on said current collector, wherein said electrocatalyst layer comprises carbon particles and electrocatalyst particles dispersed throughout a polymer matrix wherein the hydrophobicity of said polymer matrix decreases with increased distance from said current collector.

61. An electrode assembly as recited in Claim 60, wherein said gas diffusion layer comprises a porous tetrafluoroethylene fluorocarbon polymer.

62. An electrode assembly as recited in Claim 60, wherein said current collector comprises elongate strips of a metal.

63. An electrode assembly as recited in Claim 60, wherein said current collector comprises elongated strips of a metal having an average width of not greater than about 100 μm.

64. An electrode assembly as recited in Claim 60, wherein said carbon particles have an average particle size of not greater than about 10 μm.

65. An electrode assembly as recited in Claim 60, wherein said polymer matrix comprises a tetrafluoroethylene fluorocarbon polymer.

66. An electrode assembly as recited in Claim 60, wherein said polymer matrix comprises a tetrafluoroethylene fluorocarbon polymer and wherein the amount of said tetrafluoroethylene polymer in said polymer matrix decreases with increased distance from said current collector.

67. An electrode assembly as recited in Claim 60, wherein said electrocatalyst particles comprise carbon composite particles.

68. An electrode assembly as recited in Claim 60, wherein said electrocatalyst particles comprise a carbon support phase and a platinum metal active species dispersed on said support phase.

69. An electrode assembly as recited in Claim 60, wherein said electrocatalyst particles have an average size of not greater than about 5 μm.

70. An electrode assembly as recited in Claim 60, wherein said current collector and said electrocatalyst layer have a combined average thickness of not greater than about 100 μm.

71. An electrode assembly as recited in Claim 60, wherein a majority of said carbon particles in said polymer matrix are disposed near said current collector.

72. An electrode assembly, comprising:

a) a gas diffusion layer;

b) a current collector disposed on said gas diffusion layer; and

c) a gradient functional layer disposed over said current collector, wherein said gradient functional layer comprises carbon particles and electrocatalyst particles and wherein the concentration of carbon particles relative to electrocatalyst particles decreases with distance from said current collector.

73. An electrode assembly as recited in Claim 72, wherein said gas diffusion layer comprises a porous tetrafluoroethylene fluorocarbon polymer.

74. An electrode assembly as recited in Claim 72, wherein said current collector comprises elongate strips of a metal.

75. An electrode assembly as recited in Claim 72, wherein said current collector comprises elongated strips of a metal having an average width of not greater than about 100 μm.

76. An electrode assembly as recited in Claim 72, wherein said carbon particles have an average particle size of not greater than about 10 μm.

77. An electrode assembly as recited in Claim 72, wherein said gradient layer comprises a tetrafluoroethylene fluorocarbon polymer.

78. An electrode assembly as recited in Claim 72, wherein said gradient layer comprises a hydrophobicity gradient.

79. An electrode assembly as recited in Claim 72, wherein said electrocatalyst particles comprise carbon composite particles.

80. An electrode assembly as recited in Claim 72, wherein said electrocatalyst particles have an average particle size of not greater than about 10 μm.

81. An electrode assembly as recited in Claim 72, wherein said current collector and said gradient layer have an average thickness of not greater than about 50 μm.

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